

We claim:

1. A process for the production of at least one hydrofluorocarbon selected from the group consisting of difluoromethane (HFC-32), 1,1,1-trifluoroethane (HFC-143a) and 1,1-difluoroethane (HFC-152a), the process comprising:
  - (a) providing a reaction vessel,
  - (b) providing in the reaction vessel activated carbon impregnated with a strong Lewis acid fluorination catalyst wherein the strong Lewis acid catalyst is selected from the group consisting of halides of As, Sb, Al, Ti, In, V, Nb, Ta, Zr and Hf,
  - (c) activating the catalyst by passing through the activated carbon impregnated with a strong Lewis acid fluorination catalyst anhydrous hydrogen fluoride gas and chlorine gas,
  - (d) contacting, in a vapor state in the reaction vessel containing the activated catalyst, hydrogen fluoride and one or more halogenated hydrocarbons selected from the group consisting of chlorofluoromethane, dichloromethane, 1,1,1-trichloroethane, vinyl chloride, 1,1-dichloroethylene, 1,2-dichloroethylene, 1,2-dichloroethane, and 1,1-dichloroethane for a time and at a temperature to produce a product stream comprising hydrofluorocarbon product(s) corresponding to the chlorinated hydrocarbon reactant(s), and one or more of hydrogen chloride, unreacted chlorinated hydrocarbon reactant(s), under-fluorinated intermediates, and unreacted hydrogen fluoride, and
  - (e) separating the hydrofluorocarbon product(s) from the product stream.
2. A process according to claim 1 wherein the strong Lewis acid fluorination catalyst is selected from the group consisting of halides of As

and Sb.

3. A process according to claim 1 wherein the hydrogen fluoride and chlorinated hydrocarbon reactants in step (d) are preheated to a gaseous stage prior to their introduction into the reaction vessel.

4. A process according to claim 3 wherein the reactants are preheated to a superheated gaseous stage approximating the reaction temperature prior to their introduction into the reaction vessel.

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5. A process according to claim 1 wherein the amount of hydrogen fluoride employed to activate the catalyst in step (c) is in the range of from about 3 to about 10 moles of hydrogen fluoride per mole of fluorination catalyst and the amount of chlorine gas employed to activated the catalyst in step (c) is in the range of from about 1 to about 10 moles of hydrogen fluoride per mole of fluorination catalyst.

6. A process according to claim 5 wherein the amount of hydrogen fluoride gas is from about 3 to about 5 moles per mole of fluorination catalyst and the amount of chlorine gas is from about 3 to about 5 moles per mole of fluorination catalyst.

7. A process according to claim 1 wherein the reaction is conducted continuously and at least about 0.005 mole of chlorine gas per mole of chlorinated hydrocarbon reactant(s) is co-fed to the reaction vessel in step (d) to maintain catalyst activity.

8. A process according to claim 7 wherein the amount of chlorine gas co-fed to the reaction vessel is from about 0.01 to about 0.25 mole gas per mole of chlorinated hydrocarbon reactant(s).

9. A process according to claim 1 wherein the reaction is conducted as a batch reaction and least about 1 mole of chlorine gas per mole of fluorination catalyst is introduced into the reaction vessel in step (d) to  
5 maintain catalyst activity.
10. A process according to claim 9 wherein a mount of chlorine gas introduced into the reaction vessel is from about from about 3 to about 5 moles gas per mole of fluorination catalyst.
- 10 11. A process according to claim 1 wherein the ratio of the amount of hydrogen fluoride to the amount of halogenated hydrocarbon reactant(s) in step (d) is at least 2:1.
- 15 12. A process according to claim 11 wherein the ratio of hydrogen fluoride to the amount of halogenated hydrocarbon reactant(s) in step (d) is from about 2:1 to about 20:1.
- 20 13. A process according to claim 1 wherein the reaction in step (d) is conducted at a temperature within the range of from about 40 °C to about 400 °C.
- 25 14. A process according to claim 13 wherein the temperature is within the range of from about 60 °c to about 200 °C.
15. A process according to claim 1 wherein reaction in step (d) is conducted at a pressure of from about 10 psia to about 180 psia.
- 30 16. A process according to claim 1 wherein the chlorinated hydrocarbon reactant in step (d) comprises methylene chloride and the

hydrofluorocarbon product comprise difluoromethane.

17. A process according to claim 1 wherein the halogenated hydrocarbon reactant in step (d) comprises at least one of 1,1-dichloroethylene and 1,1,1-trichloroethane and the hydrofluorocarbon product comprises 1,1,1-trifluoroethane.

18. A process according to claim 1 wherein the chlorinated hydrocarbon reactant in step (d) comprises vinyl chloride and the hydrofluorocarbon product comprises 1,1-difluoroethane.

19. A process according to claim 1 wherein the reaction in step (d) is conducted as a continuous reaction and under-fluorinated intermediates in the product stream, from which the hydrofluorocarbon product has been separated, is recycled back to the reaction vessel.

20. A process according to claim 1 wherein the hydrofluorocarbon product separated from the product stream is substantially pure hydrofluorinated product.

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21. A process according to claim 1 wherein the Lewis acid fluorination catalyst comprises Sb(V) halides.

22. A process according to claim 21 wherein the amount of hydrogen fluoride employed to activate the catalyst in step (c) is in the range of from about 3 to about 10 moles of hydrogen fluoride per mole of fluorination catalyst and the amount of chlorine gas employed to activate the catalyst in step (c) is in the range of from about 1 to about 10 moles of hydrogen fluoride per mole of fluorination catalyst, the hydrogen fluoride and halogenated hydrocarbon reactants in step (d) are

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preheated to a gaseous stage prior to their introduction into the reaction vessel, the ratio of hydrogen fluoride to the amount of halogenated hydrocarbon reactant(s) in step (d) is from about 2:1 to about 20:1. the reaction in the reaction vessel is conducted at a temperature within the  
5 range of about 60 °C to about 200 °C and a pressure of atmospheric pressure, and the halogenated hydrocarbon reactant(s) is selected from the group consisting of chlorofluoromethane, dichloromethane, 1,1,1-trichloroethane, 1,1-dichloroethylene, vinyl chloride and 1,1-dichloroethane.

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